PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-069435

(43)Date of publication of application : 16.03.2001

(51)Int.Cl. H04N 5/74
G09G 5/00
G09G 5/36

(21)Application number : 11-242513

(22)Date of filing : 30.08.1999

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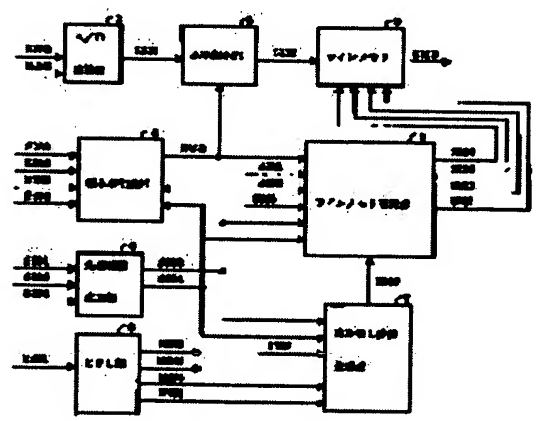
(54) TRAPEZOIDAL DISTORTION CORRECTION CIRCUIT FOR PROJECTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a trapezoidal distortion correction circuit for a projector by which a natural displayed image can be obtained.



SOLUTION: This trapezoidal distortion correction circuit consists of an A/D converter section 1 that converts an analog video signal S100 into digital video data S101, a horizontal reduction section 2 that reduces a video image of the digital video data S101 in a horizontal direction to generate reduced video data S102, a line memory 3 that stores the reduced video image data S102 in the unit of scanning lines, a reduction rate generating section 4 that generates correction data S206 deciding a reduction rate of the video image in the horizontal direction from data S202, S203 being a source of the reduction rate, a line memory control section 5 that controls write/read of the line memory 3, a processing range generating section 6 that decides the processing area of a video signal received externally, a read position generating section 7 that generates a read start position signal S207 of the stored video image from the line memory 3 on the basis of data S204, S205 being a source of the read start position, and a CPU section 8 that generates data S202, S203 being a source of the reduction rate and data S204, S205 being the source of the read start position by receiving a maximum correction amount S201 from a correction amount instruction means (not shown).

LEGAL STATUS

[Date of request for examination]	11.10.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

CLAIMS

[Claim(s)]
[Claim 1] The CPU section which generates the data which read with the data which become the origin of reduction percentage in response to the amount of amendments from the amount directions means of amendments established separately, and become the origin of a starting position, The reduction percentage generation section which determines the reduction percentage of a horizontal image in response to the data which become the origin of this reduction percentage, The read-out location generation section which reads in response to the data which become the origin of said read-out starting position, and generates a starting position signal, The A/D-conversion section which changes the analog video signal inputted into digital image data, The level contraction section to which the horizontal image of the digital image data from this A/D-conversion section is made to reduce in response to said reduction percentage, The keystone distortion amendment circuit of the projector characterized by having the Rhine memory which memorizes this reduced image data per scanning line, and the Rhine memory control section which reads with said reduction percentage and controls writing/read-out of said Rhine memory in response to a starting position signal.
[Claim 2] Said contraction image is the keystone distortion amendment circuit of the projector according to claim 1 characterized by computing with a interpolation means between contiguity pixels.
[Claim 3] Said Rhine memory is the keystone distortion amendment circuit of the projector according to claim 1 characterized by being 2 port memory, having the following capacity by the 2 scanning line above by the 1 scanning line of image data, and using it as round memory.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to keystone distortion amendment of a projector.
[Description of the Prior Art]
[0002] In a front mold projector, when it inclines and the projector body has been arranged to a screen, whenever [over a screen / angle-of-projection] does not serve as a right angle, but distortion called the keystone distortion from which the die length of a screen longitudinal direction differs by the upper and lower sides occurs.
[0003] Conventionally, the approach as shown in JP,5-37880,A as an approach of amending this keystone distortion was taken. The approach shown in this official report samples in order to change the inputted analog video signal into a digital video signal, it thins out a pixel about the scanning line to be amended, writes it in memory, and is characterized by compressing. This infanticide is determined that infanticide pixels are scattered equally.
[0004]
[Problem(s) to be Solved by the Invention] That is, by this approach, since it thinned out and was made for a pixel to only become equal, there was a trouble of an image having thinned out, having become discontinuous whenever it is a pixel, and becoming an unnatural image. This invention aims at offering the keystone distortion amendment circuit of the projector whose projection of a legible natural image is enabled by performing interpolation processing in contraction processing, in order to solve the above-mentioned technical problem.
[0005]
[Means for Solving the Problem] The keystone distortion amendment circuit of a projector which becomes this invention The CPU section which generates the data which read with the data which become the origin of reduction percentage in response to the amount of amendments from the amount directions means of amendments established separately, and become the origin of a starting position, The reduction percentage generation section which determines the reduction percentage of a horizontal image in response to the data which become the origin of this reduction percentage, The read-out location generation section which reads in response to the data which become the origin of said read-out starting position, and generates a starting position signal, The A/D-conversion section which changes the analog video signal inputted into digital image data, The level contraction section to which the horizontal image of the digital image data from this A/D-conversion section is made to reduce in response to said reduction percentage, It has the Rhine memory which memorizes this reduced image data per scanning line, and the Rhine memory control section which reads with said reduction percentage and controls writing/read-out of said Rhine memory in response to a starting position signal.
[0006] It is characterized by computing said contraction image with a interpolation means between contiguity pixels, and said Rhine memory is 2 port memory, and it has the following capacity by the 2 scanning line above by the 1 scanning line of image data, and is characterized by using it as round memory.
[0007] Since according to this invention contraction processing of the horizontal direction of a video signal was carried out for every scanning line, and it wrote in the Rhine memory and was

made the proper thing which it delays during the period and is read from the Rhine memory for every scanning line according to the amount of amendments from the amount directions means of amendments, generating of a keystone distortion can be prevented.

[0008]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail taking the case of a front mold projector using drawing. The block diagram of the trapezoidal-distortion amendment circuit of a front mold projector in which drawing 1 shows 1 operation gestalt of this invention, and drawing 2 are the explanatory views explaining horizontal contraction actuation of this invention. The A/D-conversion section from which 1 changes the analog video signal S100 into the digital image data S101 in drawing 1 , The level contraction section which 2 reduces the horizontal image of the digital image data S101, and generates the contraction image data S102, The Rhine memory 3 remembers the scanning line to be for the contraction image data S102 as a unit, The reduction percentage generation section which generates the amendment data S206 which determine the reduction percentage of a horizontal image from the data S202 and S203 with which 4 becomes the origin of reduction percentage, The Rhine memory control section by which 5 controls writing/read-out of the Rhine memory 3, The processing range generation section which determines the processing field of the video signal into which 6 is inputted from the outside, The read-out location generation section which generates the read-out starting position signal S207 of the storage image from the Rhine memory 3 from the data S204 and S205 with which 7 becomes the origin of a read-out starting position, 8 is the CPU section which generates the data S204 and S205 which become the origin of the data S202 and S203 which become the origin of said reduction percentage, and said read-out starting position in response to the amount S201 of the maximum amendments from the amount directions means of amendments which is not illustrated. In addition, the Rhine memory 3 is constituted from 2 port line memory, and the capacity has the capacity of digital image data +alpha for the 1 scanning line.

[0009] Next, actuation of the keystone distortion amendment circuit of such a front mold projector is explained. It is sampled by the sampling clock S305, is changed into the digital image data S101 in the A/D-conversion section 1, and is reduced to the contraction image data S102 in the level contraction section 2, and the inputted analog video signal S100 is memorized by the Rhine memory 3.

[0010] Then, contraction actuation of this image data is explained. An operator operates said amount directions means of amendments which is not illustrated, looking at a screen, and it is made for a trapezoidal distortion not to produce him on a screen. The amount S201 of the maximum amendments at this time is inputted into the CPU section 8. Since the time of the scanning line of the head of a display image is the largest, as for a keystone distortion, this amount S201 of the maximum amendments turns into the amount of amendments of the scanning line of the head of a display image. In the CPU section 8, the start location variation data S205 which are the variation of the initiation reduction-percentage data S202 which become the basis of the horizontal read-out starting position signal S207 of the amendment data S206 and the image data from the Rhine memory 3 which determines horizontal reduction percentage, the reduction-percentage variation data S203 which are the variation of the reduction percentage for every scanning line, the initiation start location data S204, and the start location for every scanning line are generated based on this amount S201 of the maximum amendments. Calculation generation of the contraction variation data S203 and the start location variation data S205 is carried out about a full screen as what changes to a linear based on the initiation reduction percentage data S202 and the initiation start location data S204, respectively.

[0011] The processing range generation section 6 generates the level image period S303 and the perpendicular image period S304 which show an image field based on Horizontal Synchronizing signal S301, Vertical Synchronizing signal S302, and a sampling clock S305. The reduction percentage generation section 4 generates the amendment data S206 within an image period in response to the initiation reduction percentage data S202, the reduction percentage variation data S203, Vertical Synchronizing signal S302, a sampling clock S305, the level image period

S303, and the perpendicular image period S304. About generation of this amendment data S206, contraction processing of an image, and the writing of the contraction image data S102 to the Rhine memory 3, the time of the initiation reduction percentage data S202 being 0.8 is taken for an example, and it explains using drawing 2 .
[0012] Drawing 2 shows the case of the scanning line of the head of a display image. Drawing 2 (A) is the digital image data S101 from the A/D-conversion section 1, it is continuously outputted with the period of a sampling clock S305, and a numeric value shows the output sequence. Drawing 2 (B) is the amendment data S206 which become the origin of interpolation processing of a between [the contiguity pixels at the time of contraction processing], and the write-in address to the Rhine memory 3 according to reduction percentage, with the period of a sampling clock S305, the initiation reduction percentage data S202 are added, it asks, and a numeric value is the value. Drawing 2 (C) is the write-in address S208 to the Rhine memory 3 generated by the Rhine memory control section 5 from the amendment data S206, the integer part of the amendment data S206 is used, and when integer part does not change, renewal of the address is not performed. Thus, by not updating the address, contraction of an image period is realized only for the part. Drawing 2 (D) is the write-in control signal S209 to the Rhine memory 3 generated by the Rhine memory control section 5 from the amendment data S206, and when the write-in address does not change, it has forbidden writing.
[0013] Drawing 2 (E) is what showed signs that interpolation processing of a between [the contiguity pixels at the time of contraction processing] was performed according to reduction percentage, and * expresses the operator, operation m* (m+1) determines the data of the pixel according to the weighting using the fraction part of the amendment data S206 between the data of the m-th of the digital image data S101, and eye watch (m+1), and it follows the following regulation. If the data of M and eye watch (m+1) are set to (M+1) for the m-th image data and fraction part of the amendment data S206 is set to alpha, the data of a pixel for which it asks will become "x(M+1) alpha+Mx (1-alpha)." This contraction image data S102 writes in the Rhine memory 3 with the write-in address S208 from the Rhine memory control section 5, is written in according to a control signal S209, and is memorized. Although drawing 2 explains the case of the scanning line of the head of a display image, whenever Vertical Synchronizing signal S302 comes, when adding the reduction percentage variation data S203 in the case of the scanning line after a degree, only by changing the amendment data S206, the contraction image S102 is similarly written in the Rhine memory 3, and others are memorized. Thus, contraction horizontal about a full screen is completed.
[0014] Next, actuation of writing/read-out of the Rhine memory 3 is explained further. The Rhine memory control section 5 reads with a write-in control section, consists of a control section, and controls writing/read-out in the Rhine memory 3. This Rhine memory 3 is 2 port memory with the capacity of amount-of-data +alpha for the 1 scanning line, as mentioned above, and it is using this as round memory. That is, at the time of writing, it is reset with Vertical Synchronizing signal S302, the write-in address S208 generated as mentioned above is used, and a count is not done again newly [whenever it is Horizontal Synchronizing signal S301], but whenever it arrives at the address of the last of the Rhine memory 3, it is written in from the top address again. Whenever Horizontal Synchronizing signal S301 comes at this time, the Rhine write-in starting address of the write-in data at that time and the number of write-in data are read, and whenever, as for delivery and a read-out control section, Horizontal Synchronizing signal S301 comes based on that data, the image data for the 1 scanning line are read to a control section.
[0015] An actual read-out starting position is determined by the read-out start signal S207 from the read-out location generation section 7. This read-out start signal S207 is generated by counting and adding the initiation start location data S204 to the level image period signal S303 with a sampling clock S305. It is determined that the initiation start location data S204 will become a location equivalent to the one half of the image period subtracted from the image period reduced by the amount S201 of the maximum amendments and the image period which is not reduced. Thus, read-out of the image data from the Rhine memory 3 is performed by the read-out address S210 and the read-out control signal S211 by which only the initiation start location data S204 are generated later than initiation of a regular level image period. Since this

initiation start location data S204 adds and generates the start location variation data S205 for every scanning line, the read image serves as a configuration of a reverse trapezoid as the whole 1 screen.

[0016] Since the image read from the Rhine memory 3 serves as a suitable reverse trapezoid so that a keystone distortion may be amended as explained above, the image which is made to project this and is acquired turns into an image of the square whose die length of the longitudinal direction of a screen corresponds by the upper and lower sides, and a keystone distortion is not generated. In addition, although it is necessary to carry out blanking processing of the image period to a read-out start signal, this is easily realizable by adding the level signal equivalent to a pedestal to this period.

[0017]

[Effect of the Invention] According to this invention, as explained above, according to the amount of the maximum amendments from the amount directions means of amendments, carry out contraction processing of the horizontal direction of a video signal for every scanning line, and it writes in the Rhine memory. Since it considered as the proper thing which it delays during the period and is read from the Rhine memory for every scanning line Since the read image turns into a proper reverse trapezoid image which is sufficient for amending a keystone distortion, a keystone distortion is not generated on the projected image, but since it becomes the image of the square whose die length of the longitudinal direction of a screen corresponds by the upper and lower sides, the projector which can display a natural image can be offered (claims 1 and 2). Moreover, since [contraction processing] interpolation with a contiguity pixel is performed using interpolation processing, compared with the approach of thinning out the image data of the location decided to vary equally, the projector from which a more natural projection image is acquired can be offered (claim 2). Moreover, since it constitutes as one Rhine memory, without making Rhine memory into the so-called double buffer and is used as round memory, this keystone distortion amendment circuit can offer the circuit suitable for including in ASIC etc. (claim 3).

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to keystone distortion amendment of a projector.

[Translation done.]

PRIOR ART

[Description of the Prior Art]
[0002] In a front mold projector, when it inclines and the projector body has been arranged to a screen, whenever [over a screen / angle-of-projection] does not serve as a right angle, but distortion called the keystone distortion from which the die length of a screen longitudinal direction differs by the upper and lower sides occurs.
[0003] Conventionally, the approach as shown in JP,5-37880,A as an approach of amending this keystone distortion was taken. The approach shown in this official report samples in order to change the inputted analog video signal into a digital video signal, it thins out a pixel about the scanning line to be amended, writes it in memory, and is characterized by compressing. This infanticide is determined that infanticide pixels are scattered equally.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] In this invention, as explained above, according to the amount of the maximum amendments from the amount directions means of amendments, contraction processing of the horizontal direction of a video signal was carried out for every scanning line, and it wrote in the Rhine memory and considered as the proper thing which it delays during the period and is read from the Rhine memory for every scanning line. Therefore, since the read image turns into a proper reverse trapezoid image which is sufficient for amending a keystone distortion, a keystone distortion is not generated on the projected image, but since it becomes the image of the square whose die length of the longitudinal direction of a screen corresponds by the upper and lower sides, the projector which can display a natural image can be offered (claims 1 and 2). Moreover, since [contraction processing] interpolation with a contiguity pixel is performed using interpolation processing, compared with the approach of thinning out the image data of the location decided to vary equally, the projector from which a more natural projection image is acquired can be offered (claim 2). Moreover, since it constitutes as one Rhine memory, without making Rhine memory into the so-called double buffer and is used as round memory, this keystone distortion amendment circuit can offer the circuit suitable for including in ASIC etc. (claim 3).

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] That is, by this approach, since it thinned out and was made for a pixel to only become equal, there was a trouble of an image having thinned out, having become discontinuous whenever it is a pixel, and becoming an unnatural image. This invention aims at offering the keystone distortion amendment circuit of the projector whose projection of a legible natural image is enabled by performing interpolation processing in contraction processing, in order to solve the above-mentioned technical problem.

[Translation done.]

MEANS

[Means for Solving the Problem] The keystone distortion amendment circuit of a projector which becomes this invention The CPU section which generates the data which read with the data which become the origin of reduction percentage in response to the amount of amendments from the amount directions means of amendments established separately, and become the origin of a starting position, The reduction percentage generation section which determines the reduction percentage of a horizontal image in response to the data which become the origin of this reduction percentage, The read-out location generation section which reads in response to the data which become the origin of said read-out starting position, and generates a starting position signal, The A/D-conversion section which changes the analog video signal inputted into digital image data, The level contraction section to which the horizontal image of the digital image data from this A/D-conversion section is made to reduce in response to said reduction percentage, It has the Rhine memory which memorizes this reduced image data per scanning line, and the Rhine memory control section which reads with said reduction percentage and controls writing/read-out of said Rhine memory in response to a starting position signal.
[0006] It is characterized by computing said contraction image with a interpolation means between contiguity pixels, and said Rhine memory is 2 port memory, and it has the following capacity by the 2 scanning line above by the 1 scanning line of image data, and is characterized by using it as round memory.
[0007] Since according to this invention contraction processing of the horizontal direction of a video signal was carried out for every scanning line, and it wrote in the Rhine memory and was made the proper thing which it delays during the period and is read from the Rhine memory for every scanning line according to the amount of amendments from the amount directions means of amendments, generating of a keystone distortion can be prevented.
[0008]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail taking the case of a front mold projector using drawing. The block diagram of the trapezoidal-distortion amendment circuit of a front mold projector in which drawing 1 shows 1 operation gestalt of this invention, and drawing 2 are the explanatory views explaining horizontal contraction actuation of this invention. The A/D-conversion section from which 1 changes the analog video signal S100 into the digital image data S101 in drawing 1 , The level contraction section which 2 reduces the horizontal image of the digital image data S101, and generates the contraction image data S102, The Rhine memory 3 remembers the scanning line to be for the contraction image data S102 as a unit, The reduction percentage generation section which generates the amendment data S206 which determine the reduction percentage of a horizontal image from the data S202 and S203 with which 4 becomes the origin of reduction percentage, The Rhine memory control section by which 5 controls writing/read-out of the Rhine memory 3, The processing range generation section which determines the processing field of the video signal into which 6 is inputted from the outside, The read-out location generation section which generates the read-out starting position signal S207 of the storage image from the Rhine memory 3 from the data S204 and S205 with which 7 becomes the origin of a read-out starting position, 8 is the CPU section which generates the data S204 and S205 which become the origin of the data S202 and S203 which

become the origin of said reduction percentage, and said read-out starting position in response to the amount S201 of the maximum amendments from the amount directions means of amendments which is not illustrated. In addition, the Rhine memory 3 is constituted from 2 port line memory, and the capacity has the capacity of digital image data +alpha for the 1 scanning line.

[0009] Next, actuation of the keystone distortion amendment circuit of such a front mold projector is explained. It is sampled by the sampling clock S305, is changed into the digital image data S101 in the A/D-conversion section 1, and is reduced to the contraction image data S102 in the level contraction section 2, and the inputted analog video signal S100 is memorized by the Rhine memory 3.

[0010] Then, contraction actuation of this image data is explained. An operator operates said amount directions means of amendments which is not illustrated, looking at a screen, and it is made for a trapezoidal distortion not to produce him on a screen. The amount S201 of the maximum amendments at this time is inputted into the CPU section 8. Since the time of the scanning line of the head of a display image is the largest, as for a keystone distortion, this amount S201 of the maximum amendments turns into the amount of amendments of the scanning line of the head of a display image. In the CPU section 8, the start location variation data S205 which are the variation of the initiation reduction-percentage data S202 which become the basis of the horizontal read-out starting position signal S207 of the amendment data S206 and the image data from the Rhine memory 3 which determines horizontal reduction percentage, the reduction-percentage variation data S203 which are the variation of the reduction percentage for every scanning line, the initiation start location data S204, and the start location for every scanning line are generated based on this amount S201 of the maximum amendments. Calculation generation of the contraction variation data S203 and the start location variation data S205 is carried out about a full screen as what changes to a linear based on the initiation reduction percentage data S202 and the initiation start location data S204, respectively.

[0011] The processing range generation section 6 generates the level image period S303 and the perpendicular image period S304 which show an image field based on Horizontal Synchronizing signal S301, Vertical Synchronizing signal S302, and a sampling clock S305. The reduction percentage generation section 4 generates the amendment data S206 within an image period in response to the initiation reduction percentage data S202, the reduction percentage variation data S203, Vertical Synchronizing signal S302, a sampling clock S305, the level image period S303, and the perpendicular image period S304. About generation of this amendment data S206, contraction processing of an image, and the writing of the contraction image data S102 to the Rhine memory 3, the time of the initiation reduction percentage data S202 being 0.8 is taken for an example, and it explains using drawing 2 .

[0012] Drawing 2 shows the case of the scanning line of the head of a display image. Drawing 2 (A) is the digital image data S101 from the A/D-conversion section 1, it is continuously outputted with the period of a sampling clock S305, and a numeric value shows the output sequence. Drawing 2 (B) is the amendment data S206 which become the origin of interpolation processing of a between [the contiguity pixels at the time of contraction processing], and the write-in address to the Rhine memory 3 according to reduction percentage, with the period of a sampling clock S305, the initiation reduction percentage data S202 are added, it asks, and a numeric value is the value. Drawing 2 (C) is the write-in address S208 to the Rhine memory 3 generated by the Rhine memory control section 5 from the amendment data S206, the integer part of the amendment data S206 is used, and when integer part does not change, renewal of the address is not performed. Thus, by not updating the address, contraction of an image period is realized only for the part. Drawing 2 (D) is the write-in control signal S209 to the Rhine memory 3 generated by the Rhine memory control section 5 from the amendment data S206, and when the write-in address does not change, it has forbidden writing.

[0013] Drawing 2 (E) is what showed signs that interpolation processing of a between [the contiguity pixels at the time of contraction processing] was performed according to reduction percentage, and * expresses the operator, operation m* (m+1) determines the data of the pixel

according to the weighting using the fraction part of the amendment data S206 between the data of the m-th of the digital image data S101, and eye watch (m+1), and it follows the following regulation. If the data of M and eye watch (m+1) are set to (M+1) for the m-th image data and fraction part of the amendment data S206 is set to alpha, the data of a pixel for which it asks will become "x(M+1) alpha+Mx (1-alpha)." This contraction image data S102 writes in the Rhine memory 3 with the write-in address S208 from the Rhine memory control section 5, is written in according to a control signal S209, and is memorized. Although drawing 2 explains the case of the scanning line of the head of a display image, whenever Vertical Synchronizing signal S302 comes, when adding the reduction percentage variation data S203 in the case of the scanning line after a degree, only by changing the amendment data S206, the contraction image S102 is similarly written in the Rhine memory 3, and others are memorized. Thus, contraction horizontal about a full screen is completed.

[0014] Next, actuation of writing/read-out of the Rhine memory 3 is explained further. The Rhine memory control section 5 reads with a write-in control section, consists of a control section, and controls writing/read-out in the Rhine memory 3. This Rhine memory 3 is 2 port memory with the capacity of amount-of-data +alpha for the 1 scanning line, as mentioned above, and it is using this as round memory. That is, at the time of writing, it is reset with Vertical Synchronizing signal S302, the write-in address S208 generated as mentioned above is used, and a count is not done again newly [whenever it is Horizontal Synchronizing signal S301], but whenever it arrives at the address of the last of the Rhine memory 3, it is written in from the top address again. Whenever Horizontal Synchronizing signal S301 comes at this time, the Rhine write-in starting address of the write-in data at that time and the number of write-in data are read, and whenever, as for delivery and a read-out control section, Horizontal Synchronizing signal S301 comes based on that data, the image data for the 1 scanning line are read to a control section.

[0015] An actual read-out starting position is determined by the read-out start signal S207 from the read-out location generation section 7. This read-out start signal S207 is generated by counting and adding the initiation start location data S204 to the level image period signal S303 with a sampling clock S305. It is determined that the initiation start location data S204 will become a location equivalent to the one half of the image period subtracted from the image period reduced by the amount S201 of the maximum amendments and the image period which is not reduced. Thus, read-out of the image data from the Rhine memory 3 is performed by the read-out address S210 and the read-out control signal S211 by which only the initiation start location data S204 are generated later than initiation of a regular level image period. Since this initiation start location data S204 adds and generates the start location variation data S205 for every scanning line, the read image serves as a configuration of a reverse trapezoid as the whole 1 screen.

[0016] Since the image read from the Rhine memory 3 serves as a suitable reverse trapezoid so that a keystone distortion may be amended as explained above, the image which is made to project this and is acquired turns into an image of the square whose die length of the longitudinal direction of a screen corresponds by the upper and lower sides, and a keystone distortion is not generated. In addition, although it is necessary to carry out blanking processing of the image period to a read-out start signal, this is easily realizable by adding the level signal equivalent to a pedestal to this period.

[Translation done.]

DESCRIPTION OF DRAWINGS

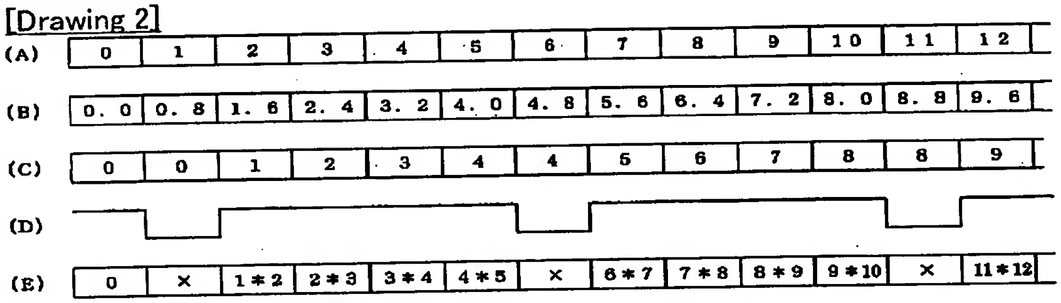
[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the trapezoidal-distortion amendment circuit of a front mold projector showing 1 operation gestalt of this invention.
[Drawing 2] It is an explanatory view explaining horizontal contraction actuation of this invention.

[Description of Notations]
1 A/D-Conversion Section
2 Level Contraction Section
3 Rhine Memory
4 Reduction Percentage Generation Section
5 Rhine Memory Control Section
6 Processing Range Generation Section
7 Read-out Location Generation Section
8 The CPU Section

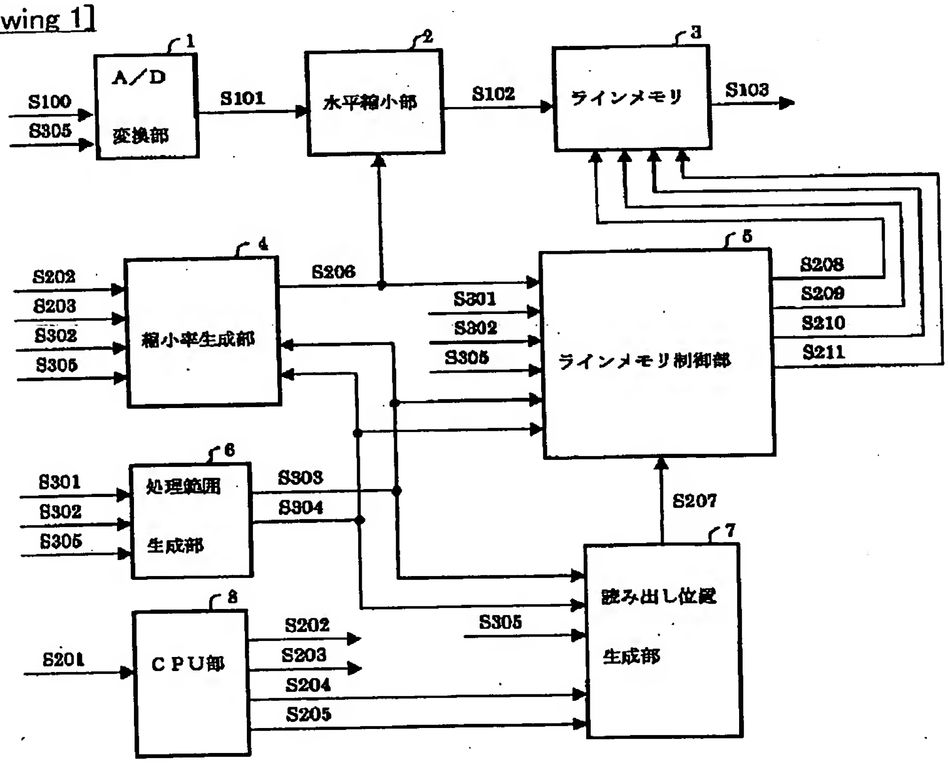
[Translation done.]

DRAWINGS

[Drawing 2]



[Drawing 1]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開2001－69435

（P2001－69435A）

(43)公開日　平成13年３月16日(2001.3.16)

(51)Int.Cl.⁷	識別記号	ＦＩ	テーマコード(参考)
Ｈ０４Ｎ　5/74		Ｈ０４Ｎ　5/74　Ｄ	５Ｃ０５８
Ｇ０９Ｇ　5/00	５５０	Ｇ０９Ｇ　5/00　５５０Ｐ	５Ｃ０８２
		５５０Ｒ	
5/36		5/36　５２０Ｇ	

審査請求　未請求　請求項の数３　ＯＬ　（全５頁）

(21)出願番号　特願平11－242513

(22)出願日　平成11年８月30日(1999.8.30)

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Ｆターム(参考)　5C058 BA27 BB04 BB12 EA02

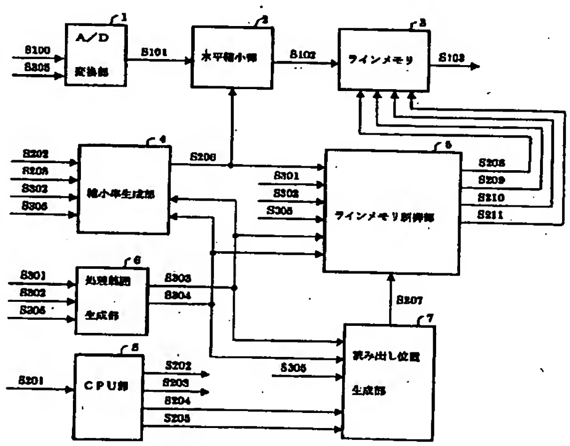
5C082 CA34 CA85 CB01 CB06 MM04 MM10

(54)【発明の名称】　プロジェクタの台形歪み補正回路

(57)【要約】

【課題】　自然な表示画像が得られるプロジェクタの台形歪み補正回路を提供する。

【解決手段】　アナログ映像信号Ｓ１００をデジタル映像データＳ１０１に変換するＡ／Ｄ変換部１、デジタル映像データＳ１０１の水平方向の映像を縮小し、縮小映像データＳ１０２を生成する水平縮小部２、縮小映像データＳ１０２を走査線を単位として記憶するラインメモリ３、縮小率の元になるデータＳ２０２、Ｓ２０３から水平方向の映像の縮小率を決定する補正データＳ２０６を生成する縮小率生成部４、ラインメモリ３の書き込み／読み出しを制御するラインメモリ制御部５、外部から入力される映像信号の処理領域を決定する処理範囲生成部６、読み出し開始位置の元になるデータＳ２０４、Ｓ２０５からラインメモリ３からの記憶映像の読み出し開始位置信号Ｓ２０７を生成する読み出し位置生成部７、図示しない補正量指示手段からの最大補正量Ｓ２０１を受けて、前記縮小率の元になるデータＳ２０２、Ｓ２０３および前記読み出し開始位置の元になるデータＳ２０４、Ｓ２０５を生成するＣＰＵ部８とで構成する。



【特許請求の範囲】
【請求項１】 別途設けた補正量指示手段からの補正量を受けて縮小率の元になるデータと読み出し開始位置の元になるデータを生成するＣＰＵ部と、
この縮小率の元になるデータを受けて水平方向の映像の縮小率を決定する縮小率生成部と、
前記読み出し開始位置の元になるデータを受けて読み出し開始位置信号を生成する読み出し位置生成部と、
入力されるアナログ映像信号をデジタル映像データに変換するＡ／Ｄ変換部と、
前記縮小率を受けて、このＡ／Ｄ変換部からのデジタル映像データの水平方向の映像を縮小させる水平縮小部と、
この縮小された映像データを走査線単位で記憶するラインメモリと、
前記縮小率と読み出し開始位置信号を受けて前記ラインメモリの書き込み／読み出しを制御するラインメモリ制御部と、を有することを特徴とするプロジェクタの台形歪み補正回路。
【請求項２】 前記縮小画像は隣接画素間で補間手段により算出することを特徴とする請求項１記載のプロジェクタの台形歪み補正回路。
【請求項３】 前記ラインメモリは２ポートメモリであり、映像データの１走査線分以上２走査線分以下の容量を有し、巡回メモリとして使用することを特徴とする請求項１記載のプロジェクタの台形歪み補正回路。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、プロジェクタの台形歪み補正に関するものである。
【従来の技術】
【０００２】フロント型プロジェクタにおいては、プロジェクタ本体をスクリーンに対して傾斜して配置した場合、スクリーンに対する投射角度が直角とならず、上下で画面横方向の長さが異なる台形歪みと呼ばれる歪みが発生する。
【０００３】従来、この台形歪みを補正する方法としては特開平５－３７８８０号公報に示されるような方法が採られていた。この公報で示される方法は、入力されたアナログ映像信号をデジタル映像信号に変換するためにサンプリングを行い、補正が必要な走査線については、画素を間引いてメモリに書き込み、圧縮をすることを特徴とするものである。この間引きは、間引き画素が均等に散らばるように決定される。
【０００４】
【発明が解決しようとする課題】即ち、この方法では間引き画素が均等になるようにするだけであるから、映像が間引き画素の度に不連続となり不自然な映像となるという問題点があった。本発明は、上記課題を解決するために、縮小処理において補間処理を行うことで見やすい自然な映像を投影可能とするプロジェクタの台形歪み補正回路を提供することを目的とする。
【０００５】
【課題を解決するための手段】本発明になるプロジェクタの台形歪み補正回路は、別途設けた補正量指示手段からの補正量を受けて縮小率の元になるデータと読み出し開始位置の元になるデータを生成するＣＰＵ部と、この縮小率の元になるデータを受けて水平方向の映像の縮小率を決定する縮小率生成部と、前記読み出し開始位置の元になるデータを受けて読み出し開始位置信号を生成する読み出し位置生成部と、入力されるアナログ映像信号をデジタル映像データに変換するＡ／Ｄ変換部と、前記縮小率を受けて、このＡ／Ｄ変換部からのデジタル映像データの水平方向の映像を縮小させる水平縮小部と、この縮小された映像データを走査線単位で記憶するラインメモリと、前記縮小率と読み出し開始位置信号を受けて前記ラインメモリの書き込み／読み出しを制御するラインメモリ制御部と、を有するものである。
【０００６】前記縮小画像は隣接画素間で補間手段により算出することを特徴とするものであり、また前記ラインメモリは２ポートメモリであり、映像データの１走査線分以上２走査線分以下の容量を有し、巡回メモリとして使用することを特徴とするものである。
【０００７】本発明によれば、補正量指示手段からの補正量に応じて、走査線毎に映像信号の水平方向を縮小処理してラインメモリに書き込み、走査線毎に適宜の期間遅らせてラインメモリから読み出すことにしたので、台形歪みの発生を防止できる。
【０００８】
【発明の実施の形態】以下、図を用いて本発明についてフロント型プロジェクタを例にとって詳細に説明する。図１は、本発明の一実施形態を示すフロント型プロジェクタの台形歪補正回路のブロック図、図２は本発明の水平方向の縮小動作を説明する説明図である。図１において、１はアナログ映像信号Ｓ１００をデジタル映像データＳ１０１に変換するＡ／Ｄ変換部、２はデジタル映像データＳ１０１の水平方向の映像を縮小し、縮小映像データＳ１０２を生成する水平縮小部、３は縮小映像データＳ１０２を走査線を単位として記憶するラインメモリ、４は縮小率の元になるデータＳ２０２、Ｓ２０３から水平方向の映像の縮小率を決定する補正データＳ２０６を生成する縮小率生成部、５はラインメモリ３の書き込み／読み出しを制御するラインメモリ制御部、６は外部から入力される映像信号の処理領域を決定する処理範囲生成部、７は読み出し開始位置の元になるデータＳ２０４、Ｓ２０５からラインメモリ３からの記憶映像の読み出し開始位置信号Ｓ２０７を生成する読み出し位置生成部、８は図示しない補正量指示手段からの最大補正量Ｓ２０１を受けて、前記縮小率の元になるデータＳ２０２、Ｓ２０３および前記読み出し開始位置の元になるデ

ータＳ２０４、Ｓ２０５を生成するＣＰＵ部である。なお、ラインメモリ３は２ポートラインメモリで構成し、その容量は１走査線分のデジタル映像データ＋αの容量を有している。

【０００９】次に、このようなフロント型プロジェクタの台形歪み補正回路の動作について説明する。入力されたアナログ映像信号Ｓ１００はサンプリングクロックＳ３０５によりサンプリングされ、Ａ／Ｄ変換部１でデジタル映像データＳ１０１に変換され、水平縮小部２で縮小映像データＳ１０２に縮小され、ラインメモリ３に記憶される。

【００１０】続いて、この映像データの縮小動作について説明する。操作者は画面を見ながら前記図示しない補正量指示手段を操作し、画面に台形歪が生じないようにする。このときの最大補正量Ｓ２０１がＣＰＵ部８に入力される。台形歪みは表示画像の先頭の走査線の時が最も大きいので、この最大補正量Ｓ２０１が表示画像の先頭の走査線の補正量となる。ＣＰＵ部８では、この最大補正量Ｓ２０１をもとに、水平方向の縮小率を決定する補正データＳ２０６とラインメモリ３からの映像データの水平方向の読み出し開始位置信号Ｓ２０７のもとになる開始縮小率データＳ２０２、走査線毎の縮小率の変化量である縮小率変化量データＳ２０３、開始スタート位置データＳ２０４および走査線毎のスタート位置の変化量であるスタート位置変化量データＳ２０５を生成する。縮小変化量データＳ２０３およびスタート位置変化量データＳ２０５は、全画面についてリニアに変化するものとして、それぞれ開始縮小率データＳ２０２および開始スタート位置データＳ２０４をもとにして算出生成される。

【００１１】処理範囲生成部６は水平同期信号Ｓ３０１、垂直同期信号Ｓ３０２およびサンプリングクロックＳ３０５を元に画像領域を示す水平画像期間Ｓ３０３および垂直画像期間Ｓ３０４を生成する。縮小率生成部４は開始縮小率データＳ２０２、縮小率変化量データＳ２０３、垂直同期信号Ｓ３０２、サンプリングクロックＳ３０５、水平画像期間Ｓ３０３および垂直画像期間Ｓ３０４を受けて画像期間内で補正データＳ２０６を生成する。この補正データＳ２０６の生成と画像の縮小処理、およびラインメモリ３への縮小映像データＳ１０２の書き込みにつき、開始縮小率データＳ２０２が０．８のときを例にとって、図２を用いて説明する。

【００１２】図２は表示画像の先頭の走査線の場合を示している。図２（Ａ）はＡ／Ｄ変換部１からのデジタル映像データＳ１０１であり、サンプリングクロックＳ３０５の周期で連続的に出力されてくるもので、数値はその出力順番を示すものである。図２（Ｂ）は縮小率に応じて縮小処理時の隣接画素間との補間処理およびラインメモリ３への書き込みアドレスの元になる補正データＳ２０６であり、サンプリングクロックＳ３０５の周期で開始縮小率データＳ２０２を加算して求められるもので、数値はその値である。図２（Ｃ）は補正データＳ２０６からラインメモリ制御部５で生成されたラインメモリ３への書き込みアドレスＳ２０８で、補正データＳ２０６の整数部を用いており、整数部が変化しない場合はアドレスの更新は行われない。このようにアドレスの更新を行わないことによって、その分だけ画像期間の縮小が実現されるのである。図２（Ｄ）は補正データＳ２０６からラインメモリ制御部５で生成されたラインメモリ３への書き込み制御信号Ｓ２０９であり、書き込みアドレスが変化しないときは書き込みを禁止している。

【００１３】図２（Ｅ）は縮小率に応じて縮小処理時の隣接画素間との補間処理を行う様子を示したもので、＊は演算子を表わしており、演算ｍ＊（ｍ＋１）はデジタル映像データＳ１０１のｍ番目と（ｍ＋１）番目のデータ間で補正データＳ２０６の小数部を用いてその重み付けに応じてその画素のデータを決定するものであり、次の規則に従う。ｍ番目の映像データをＭ、（ｍ＋１）番目のデータを（Ｍ＋１）とし、補正データＳ２０６の小数部をαとすると、求める画素のデータは「（Ｍ＋１）×α＋Ｍ×（１－α）」となる。この縮小映像データＳ１０２がラインメモリ３にラインメモリ制御部５からの書き込みアドレスＳ２０８と書き込み制御信号Ｓ２０９に従って書き込まれ、記憶される。図２は表示画像の先頭の走査線の場合を説明しているが、次以降の走査線の場合は、垂直同期信号Ｓ３０２が来るたびに縮小率変化量データＳ２０３を加算することにより補正データＳ２０６を変化させるだけで他は同じようにしてラインメモリ３に縮小映像Ｓ１０２が書き込まれ、記憶される。このようにして、全画面について水平方向の縮小が完成される。

【００１４】次に、ラインメモリ３の書き込み／読み出しの動作についてさらに説明する。ラインメモリ制御部５は書き込み制御部と読み出し制御部とからなり、ラインメモリ３への書き込み／読み出しを制御する。このラインメモリ３は前述したように１走査線分のデータ量＋αの容量をもつ２ポートメモリであり、これを巡回メモリとして使用している。つまり、書き込み時は、垂直同期信号Ｓ３０２でリセットされ、前述のようにして生成される書き込みアドレスＳ２０８が用いられ、水平同期信号Ｓ３０１のたびに新規にカウントをし直すのではなく、ラインメモリ３の最後のアドレスに達するたびに先頭のアドレスから又書き込まれる。この時、水平同期信号Ｓ３０１が来るたびに、その時の書き込みデータのライン書き込み開始アドレス、書き込みデータ数を読み出し制御部に送り、読み出し制御部はそのデータを元に水平同期信号Ｓ３０１が来るたびに１走査線分の映像データを読み出す。

【００１５】実際の読み出し開始位置は、読み出し位置生成部７からの読み出し開始信号Ｓ２０７によって決定

される。この読み出し開始信号Ｓ２０７は水平画像期間信号Ｓ３０３に開始スタート位置データＳ２０４をサンプリングクロックＳ３０５でカウントして加えることによって生成する。開始スタート位置データＳ２０４は最大補正量Ｓ２０１により縮小された画像期間と縮小されない画像期間とから減算した画像期間の半分に相当する位置になるように決定される。このようにして、ラインメモリ３からの映像データの読み出しは規定の水平画像期間の開始より開始スタート位置データＳ２０４だけ遅れて生成される読み出しアドレスＳ２１０および読み出し制御信号Ｓ２１１によって実行される。この開始スタート位置データＳ２０４は走査線毎にスタート位置変化量データＳ２０５を加算して生成するので、読み出された映像は一画面全体としては逆台形の形状となる。

【００１６】以上説明したように、ラインメモリ３から読み出された映像は台形歪みを補正するように適切な逆台形となるから、これを投影させて得られる映像は上下で画面の横方向の長さが一致する四角形の映像となり、台形歪みは発生しない。なお、読み出し開始信号までの画像期間をブランキング処理する必要があるが、これは、この期間にブランキングレベルに相当するレベル信号を付加することで容易に実現できる。

【００１７】

【発明の効果】本発明によれば、以上説明したように、補正量指示手段からの最大補正量に応じて走査線毎に映像信号の水平方向を縮小処理してラインメモリに書き込み、走査線毎に適宜の期間遅らせてラインメモリから読み出すこととしたので、読み出された映像は台形歪みを

補正するに足る適正な逆台形映像となるので、投影された映像には台形歪みは発生せず、上下で画面の横方向の長さが一致する四角形の映像となるから、自然な映像を表示できるプロジェクタを提供できる（請求項１、２）。また、縮小処理は補間処理を用いて隣接画素との補間を行うこととしたので、均等にばらつくように決められた位置の映像データを間引く方法に比べて、より自然な投影像が得られるプロジェクタを提供できる（請求項２）。また、ラインメモリをいわゆるダブルバッファとせずに一つのラインメモリとして構成し、巡回メモリとして使用するので、この台形歪み補正回路はＡＳＩＣ等に組み込むのに適した回路を提供できる（請求項３）。

【図面の簡単な説明】

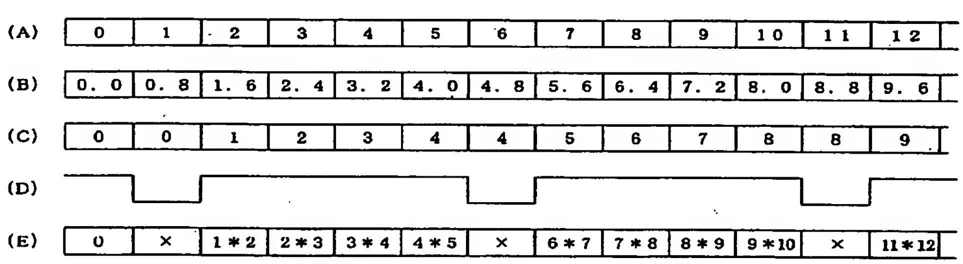
【図１】本発明の一実施形態を示すフロント型プロジェクタの台形歪補正回路のブロック図である。

【図２】本発明の水平方向の縮小動作を説明する説明図である。

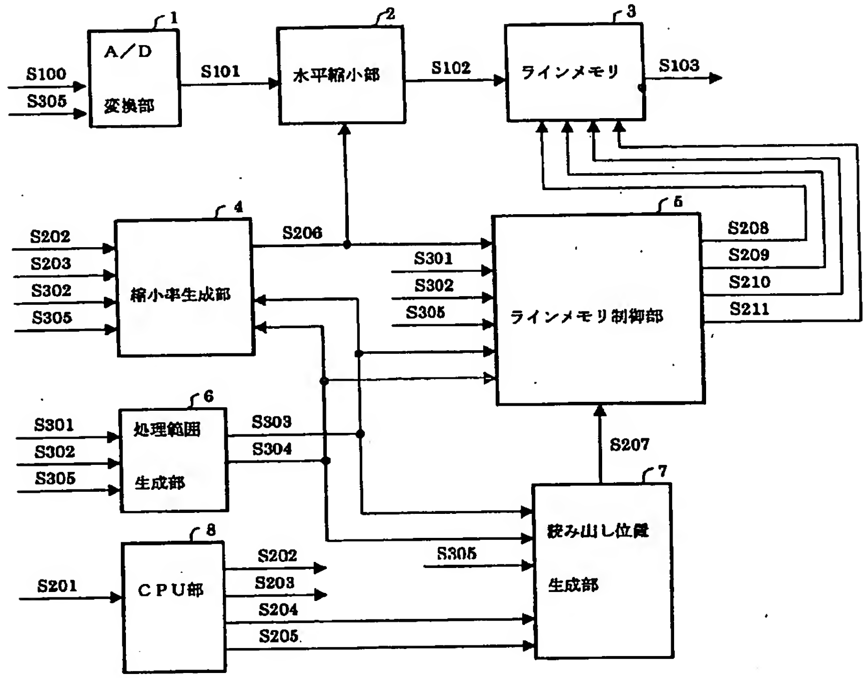
【符号の説明】

１　Ａ／Ｄ変換部
２　水平縮小部
３　ラインメモリ
４　縮小率生成部
５　ラインメモリ制御部
６　処理範囲生成部
７　読み出し位置生成部
８　ＣＰＵ部

【図２】



【図１】


1
A／D
変換部
S100
S305
S101
2
水平縮小部
S102
3
ラインメモリ
S103
4
縮小率生成部
S202
S203
S302
S305
S206
5
ラインメモリ制御部
S301
S302
S305
S208
S209
S210
S211
6
処理範囲
生成部
S301
S302
S305
S303
S304
S207
7
読み出し位置
生成部
S305
8
ＣＰＵ部
S201
S202
S203
S204
S205